



Gasoline Composition in the US (1976-2005)

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Region 3, LUST Conference

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EPA Gasoline Studies

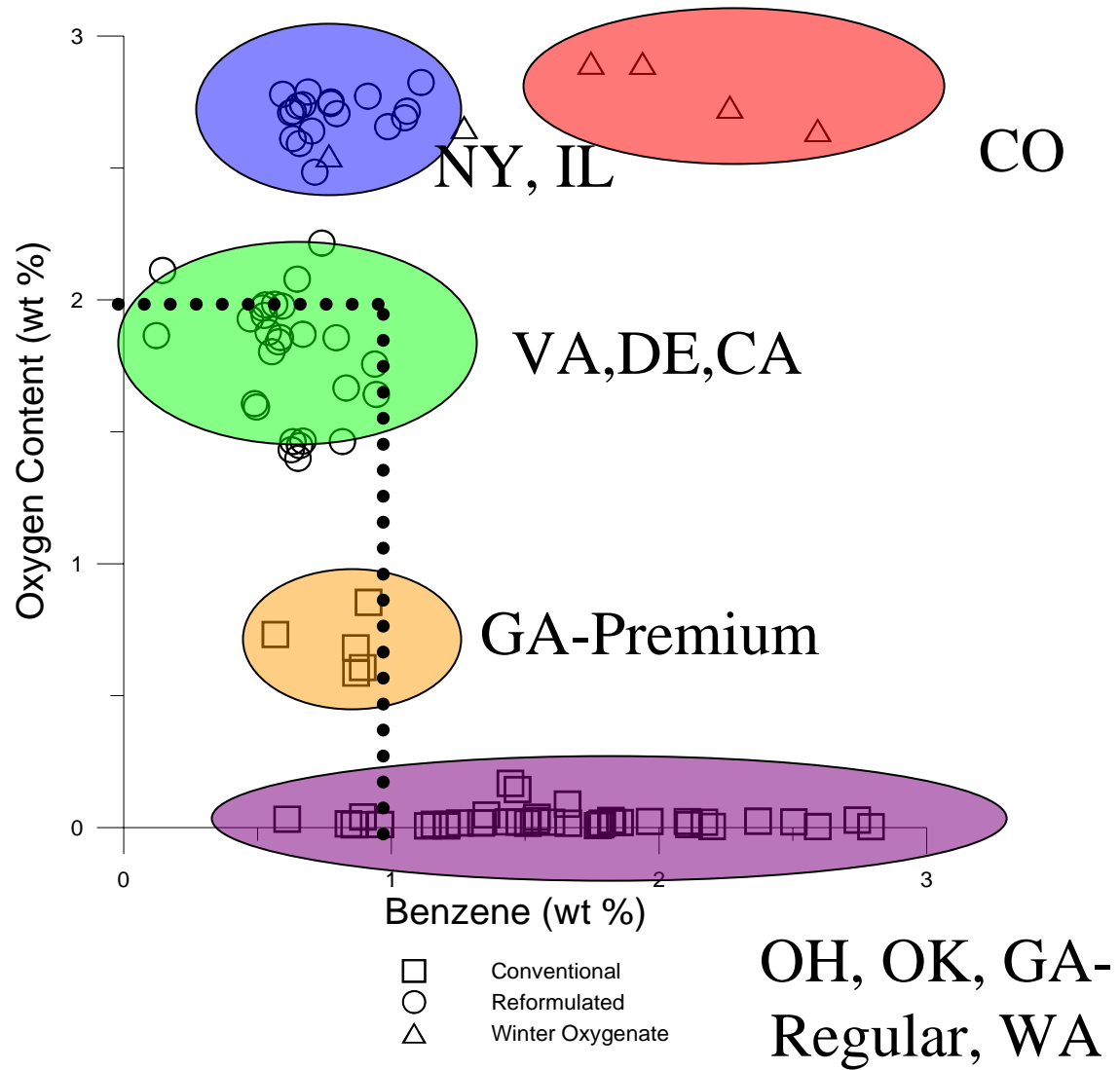
- U.S. Fuel Sampling
 - 2004/2005 Gasoline study: Weaver, et al, 2005
 - <http://www.epa.gov/athens/publications>
 - LUSTLine, # 51.
 - 2005/2006 Gasoline/Diesel/Avgas
- 30 year U.S. Gasoline historical study (1976-2005)



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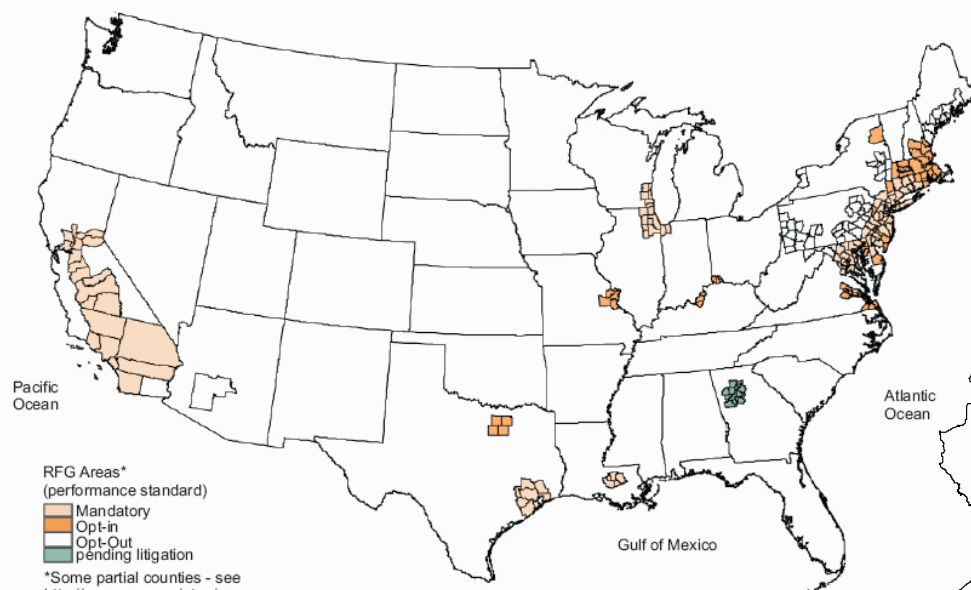
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Oxygen (wt %)/Benzene (wt %)



Region 3 RFG Areas

United States RFG Areas



RFG Areas*
(performance standard)

Mandatory
Opt-In
Opt-Out
pending litigation

*Some partial counties - see
<http://www.epa.gov/otaq/rfg/whereyoulive.htm>

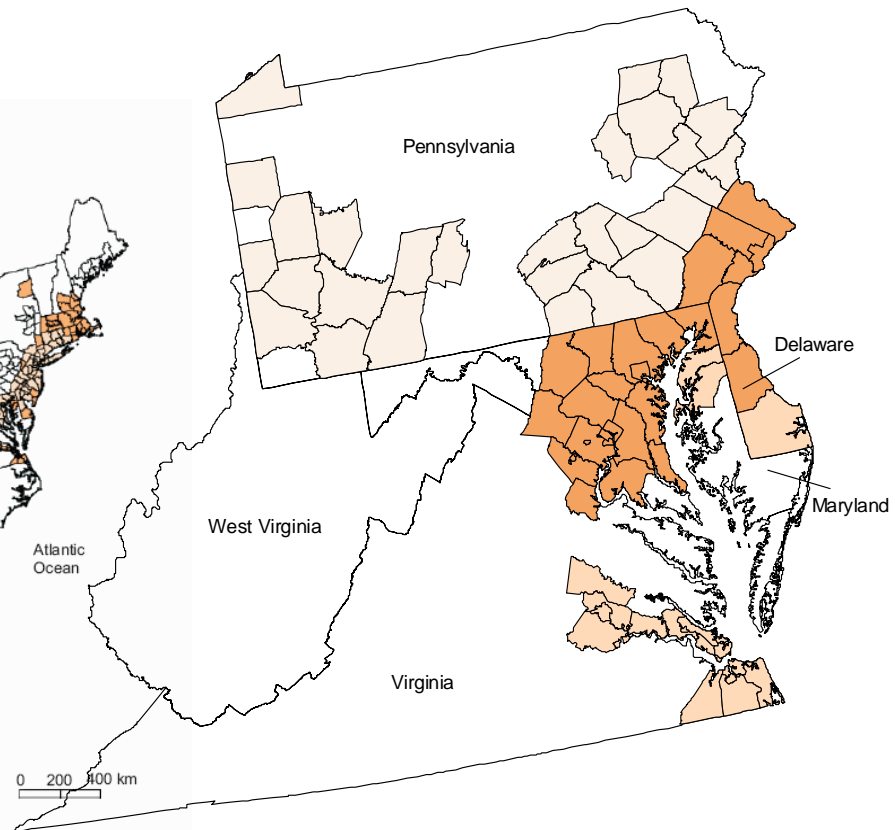
Source: U.S. EPA website "Where You Live" Current RFG Areas

Note: Alaska, Hawaii and U.S. territories are exempted from federal volatility regulations

0 200 400 km

U.S. EPA Athens, GA
March 2006
<http://www.epa.gov/athens/research/regsupport/ust.html>

*Source: U.S. EPA website
"Where You Live" Current RFG Areas



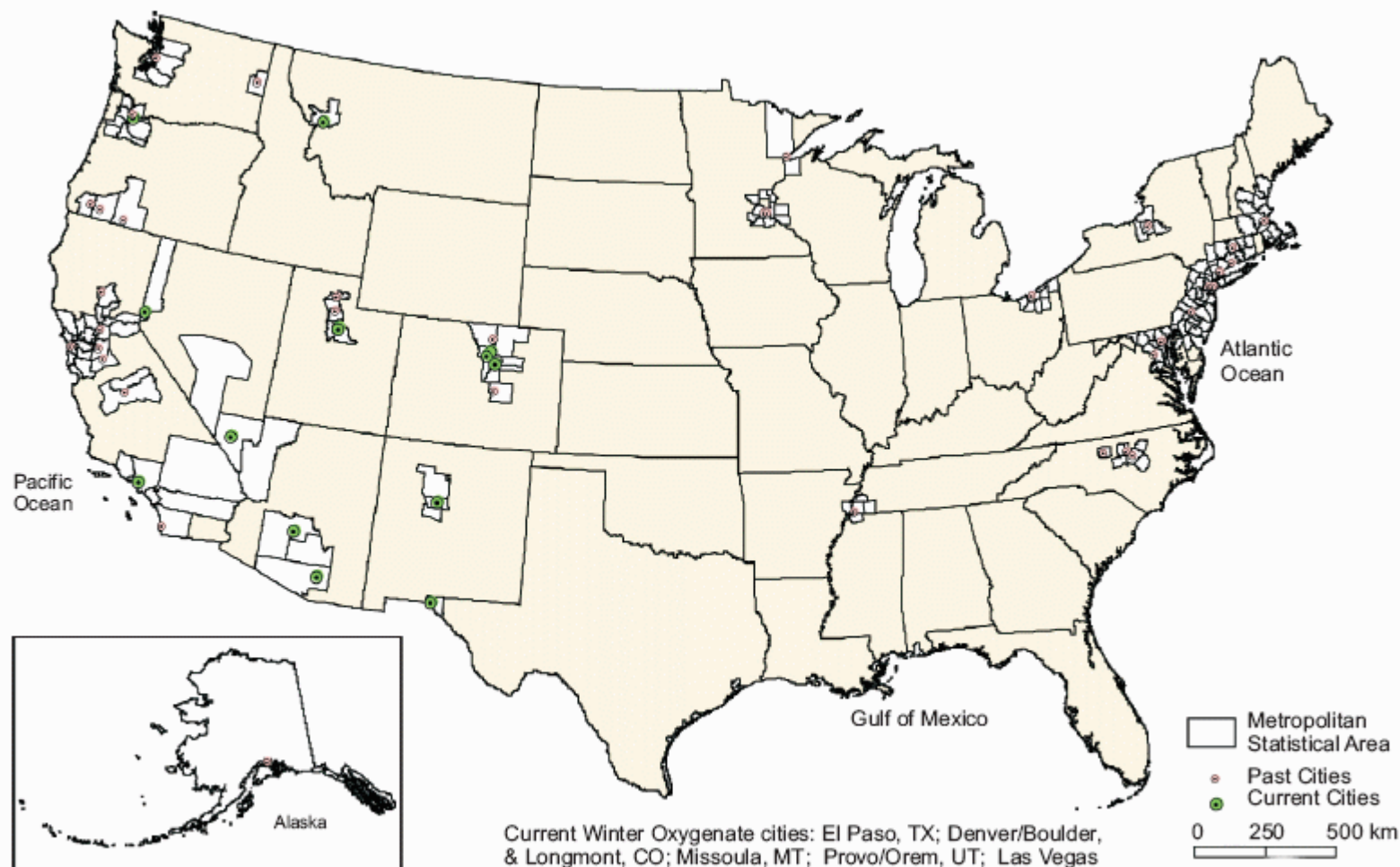
RFG*
(performance standard)

Mandatory
Opt-In
Opt-Out

*Some partial counties possible--see
<http://www.epa.gov/otaq/rfg/whereyoulive.htm>

0 40 80 120 Kilometers

U.S. Winter Oxygenated Fuel Program

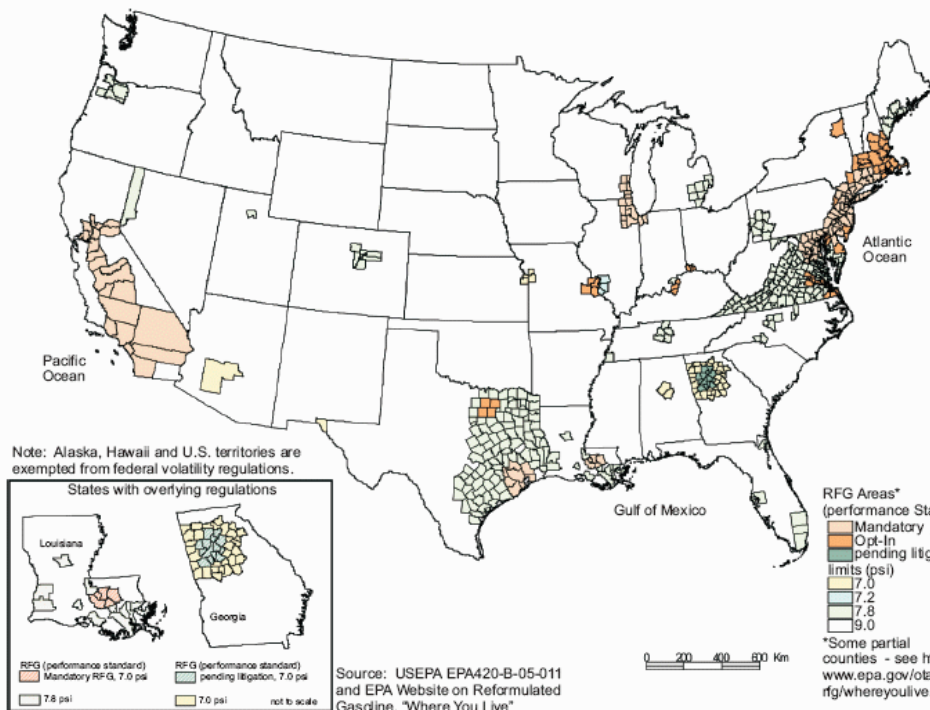


Current Winter Oxygenate cities: El Paso, TX; Denver/Boulder, & Longmont, CO; Missoula, MT; Provo/Orem, UT; Las Vegas & Reno, NV; Phoenix & Tucson, AZ; Los Angeles, CA; Albuquerque, NM; Portland, OR. Minnesota has adopted a year-round, statewide oxygen mandate

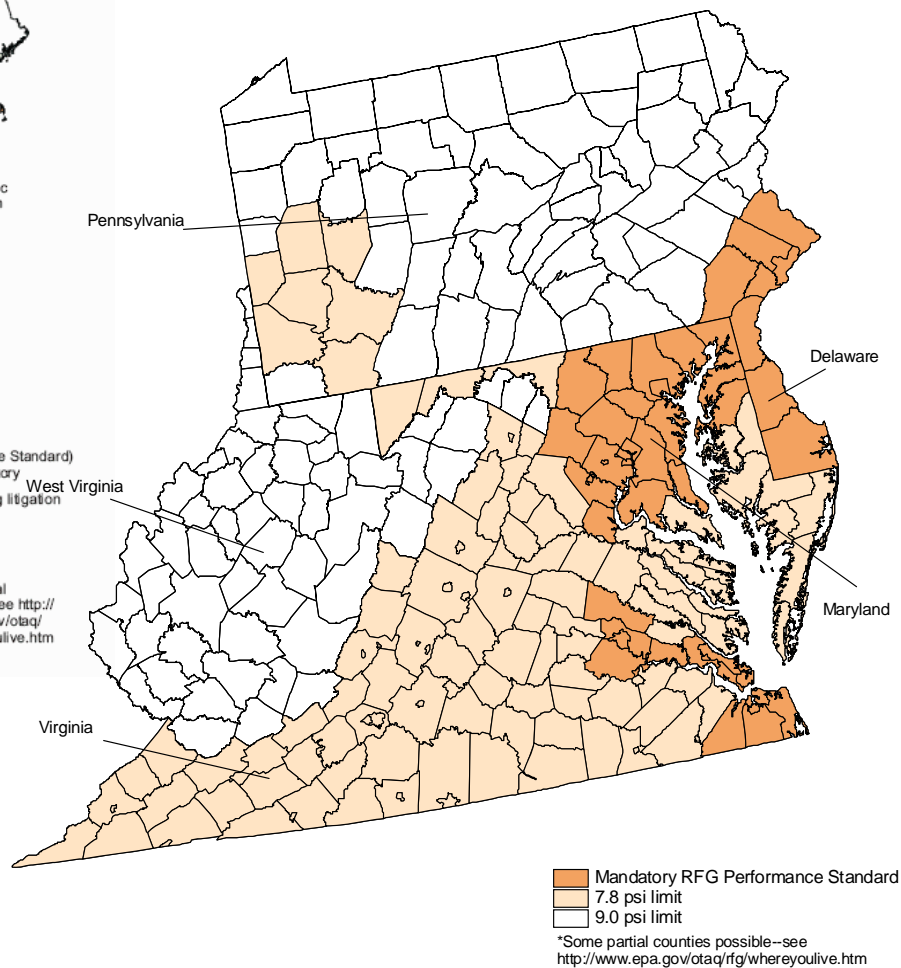
U.S. EPA Athens, Georgia
<http://www.epa.gov/athens/research/regsupport/ust.html>

Source: US EPA EPA420-B-05-013
 "State Winter Oxygenated Fuel Program Requirements" <http://www.epa.gov/otaq/regsfuels/420b05013.pdf>

U.S. Summertime Vapor Pressure Limits



Region 3 Summertime Vapor Pressure Limits



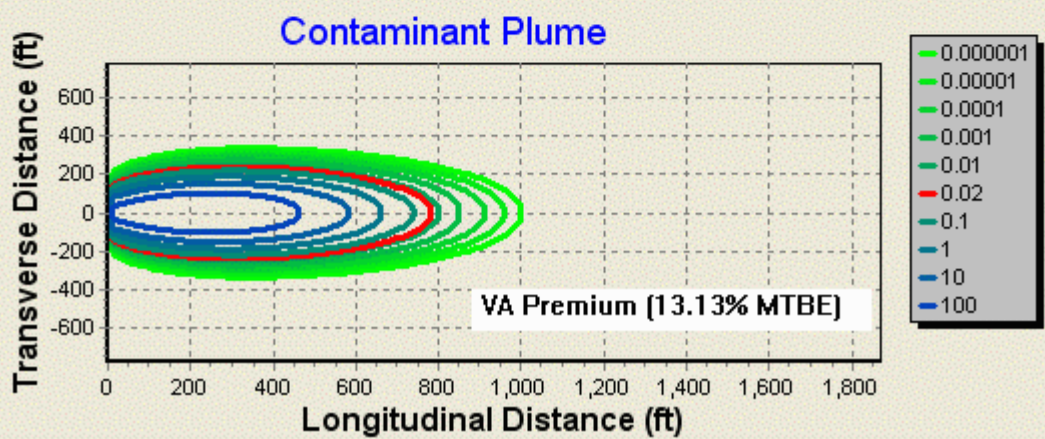
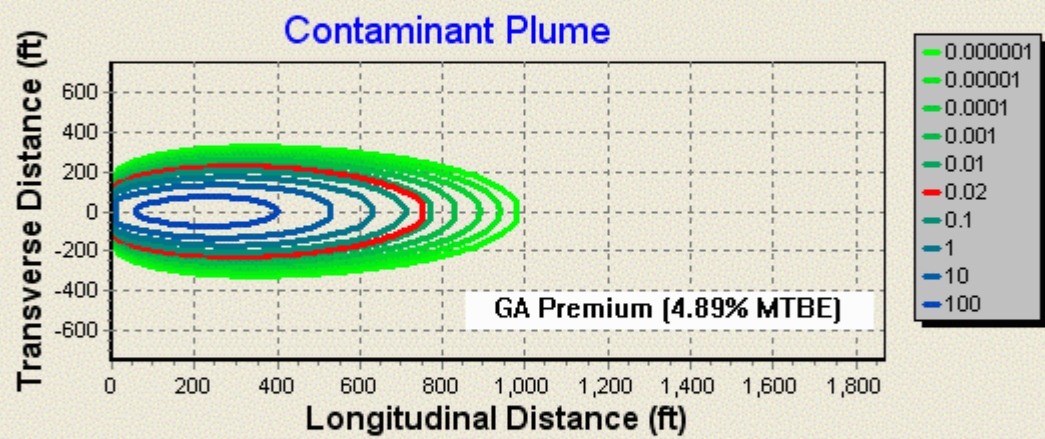
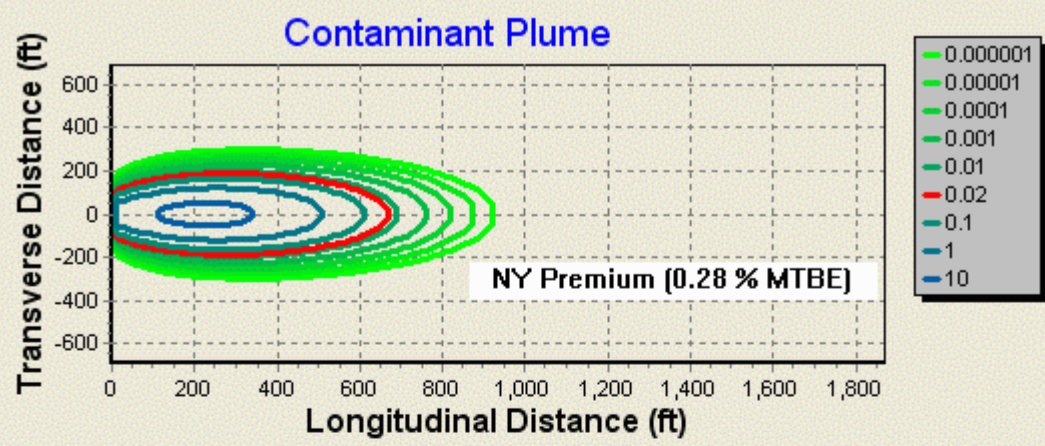
State MTBE Bans and Phaseout Dates in the United States





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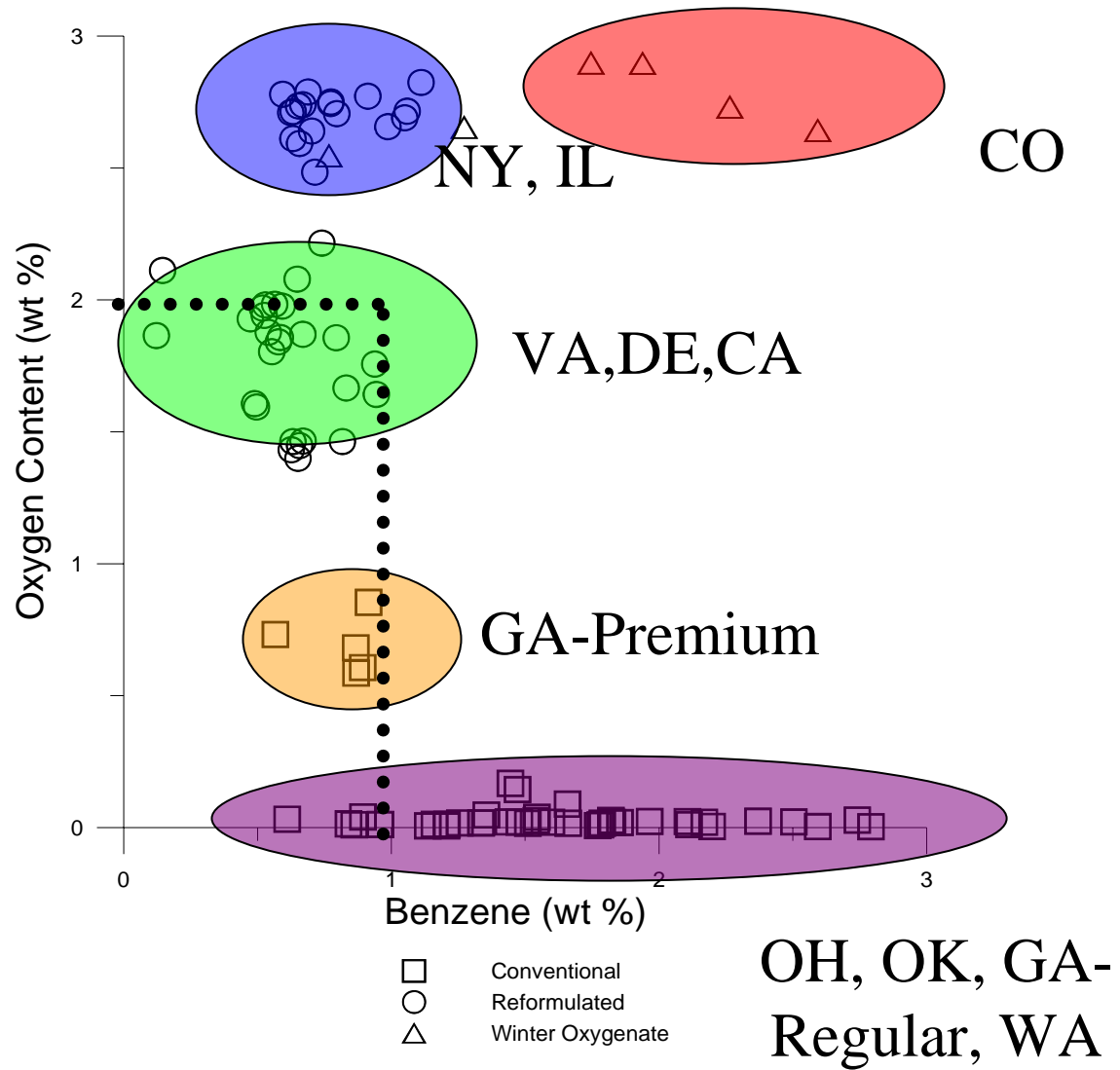




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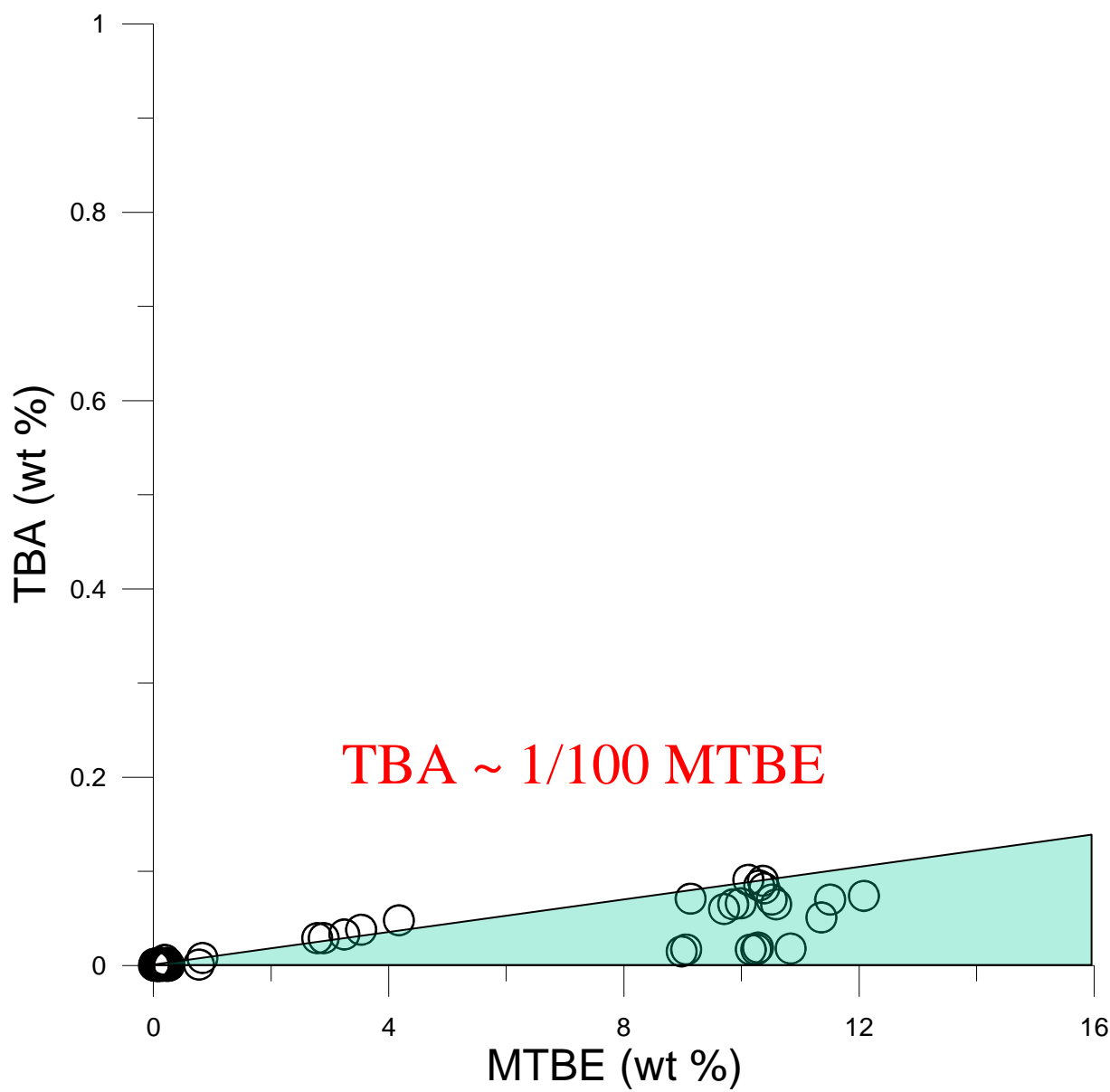
Oxygen (wt %)/Benzene (wt %)





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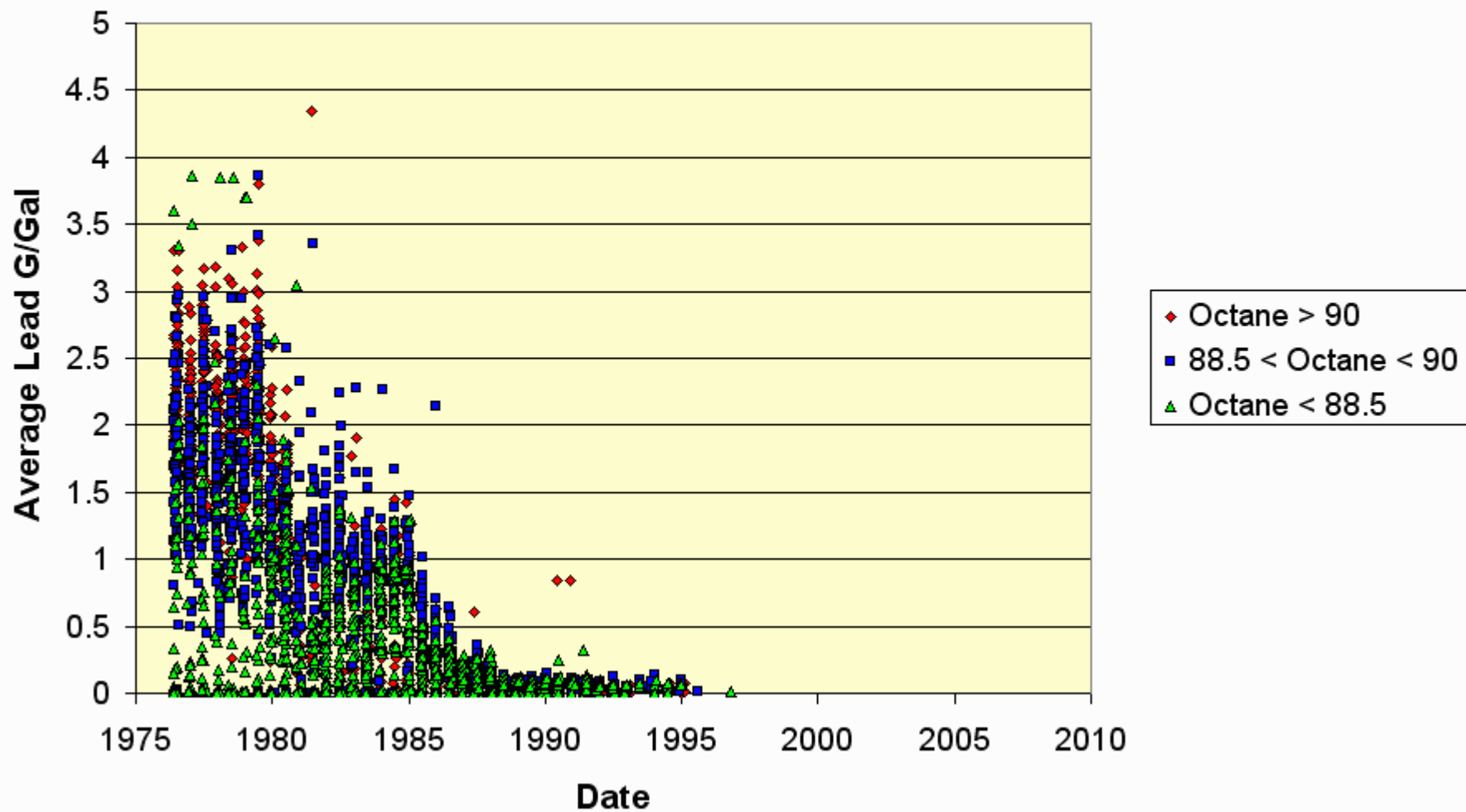
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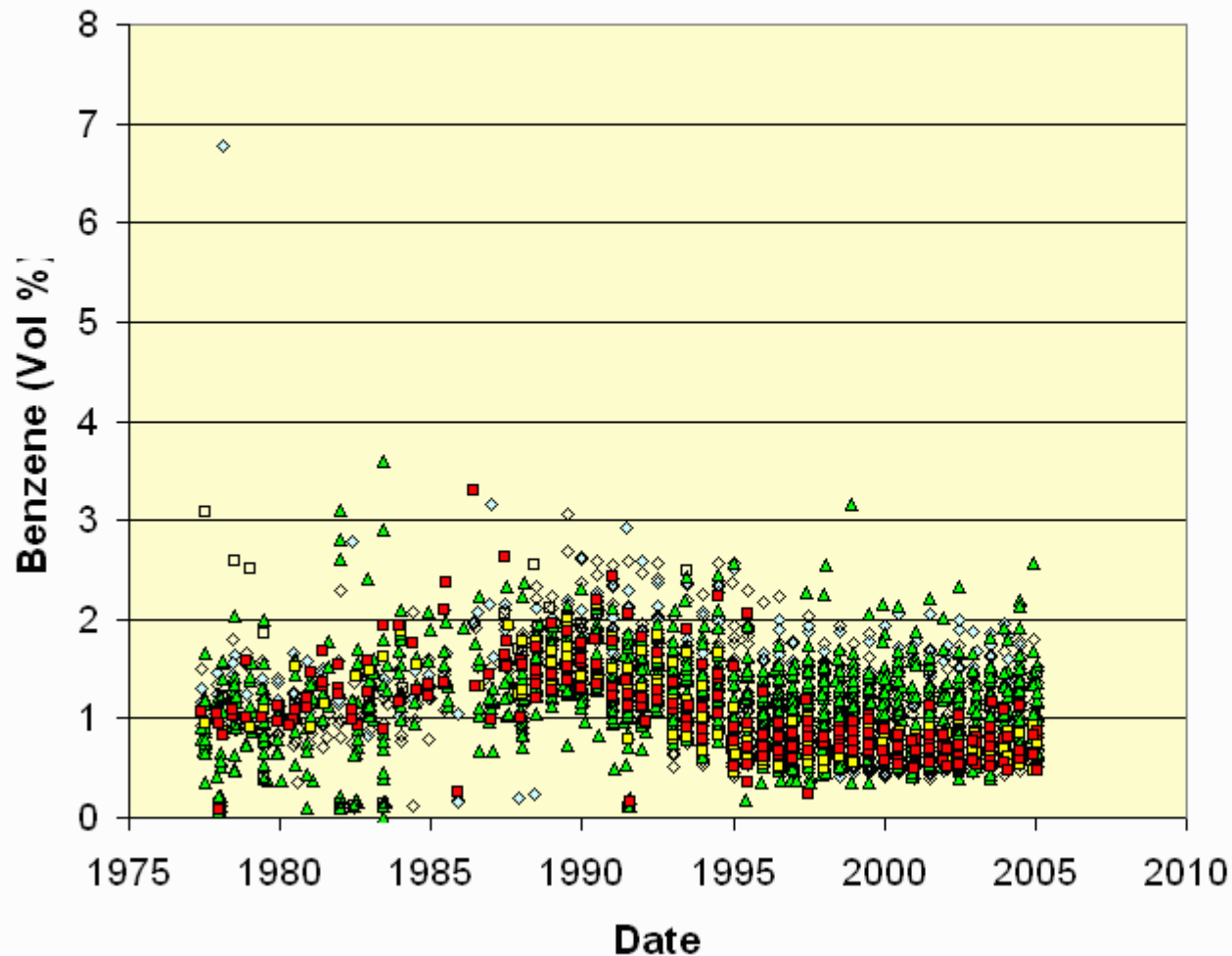
National Data Sources

- EPA Office of Transportation and Air Quality:
 - RFG compliance data, 2x per year, ~10,000 samples (public)
 - Benzene, oxygenates, air quality model parameters
 - Conventional & Reformulated production/importation data, 2x per year, (confidential)
- Northrop Grumman, Bartlesville, Oklahoma
 - Voluntary industry consortium since 1930s
 - Electronic data **1976-2005**
 - 174 Cities (incomplete involvement)
 - 2x per year, 800 to 3,000 samples
 - Benzene, oxygenates, classes, physical properties
 - Available to the public at a cost
- States also have data, some considered confidential

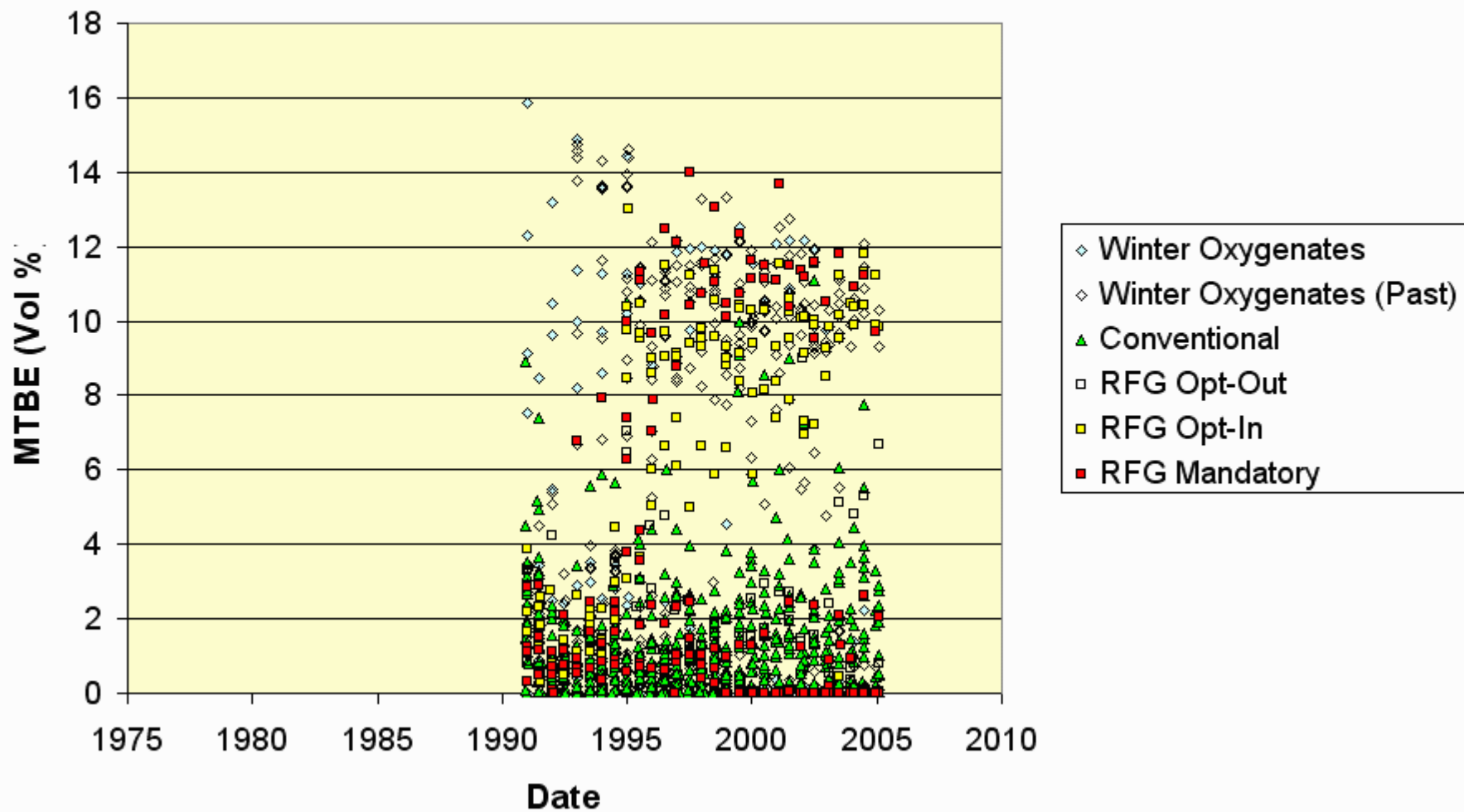
Average Lead Content (G/Gal)
1,729 Averages (27,837 Data Points)



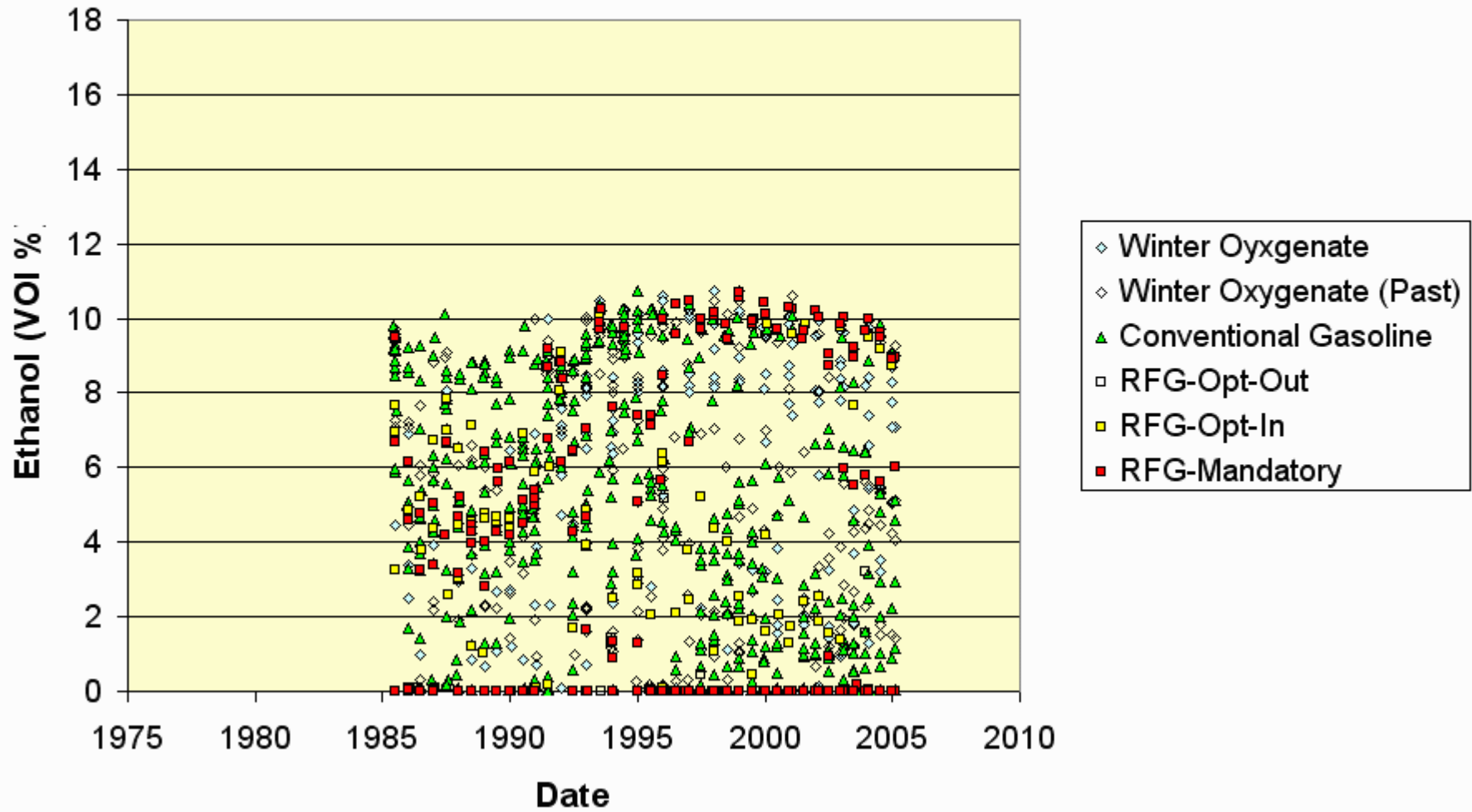
Average Benzene (Vol %)
2,633 Averages (48,089 Data Points)



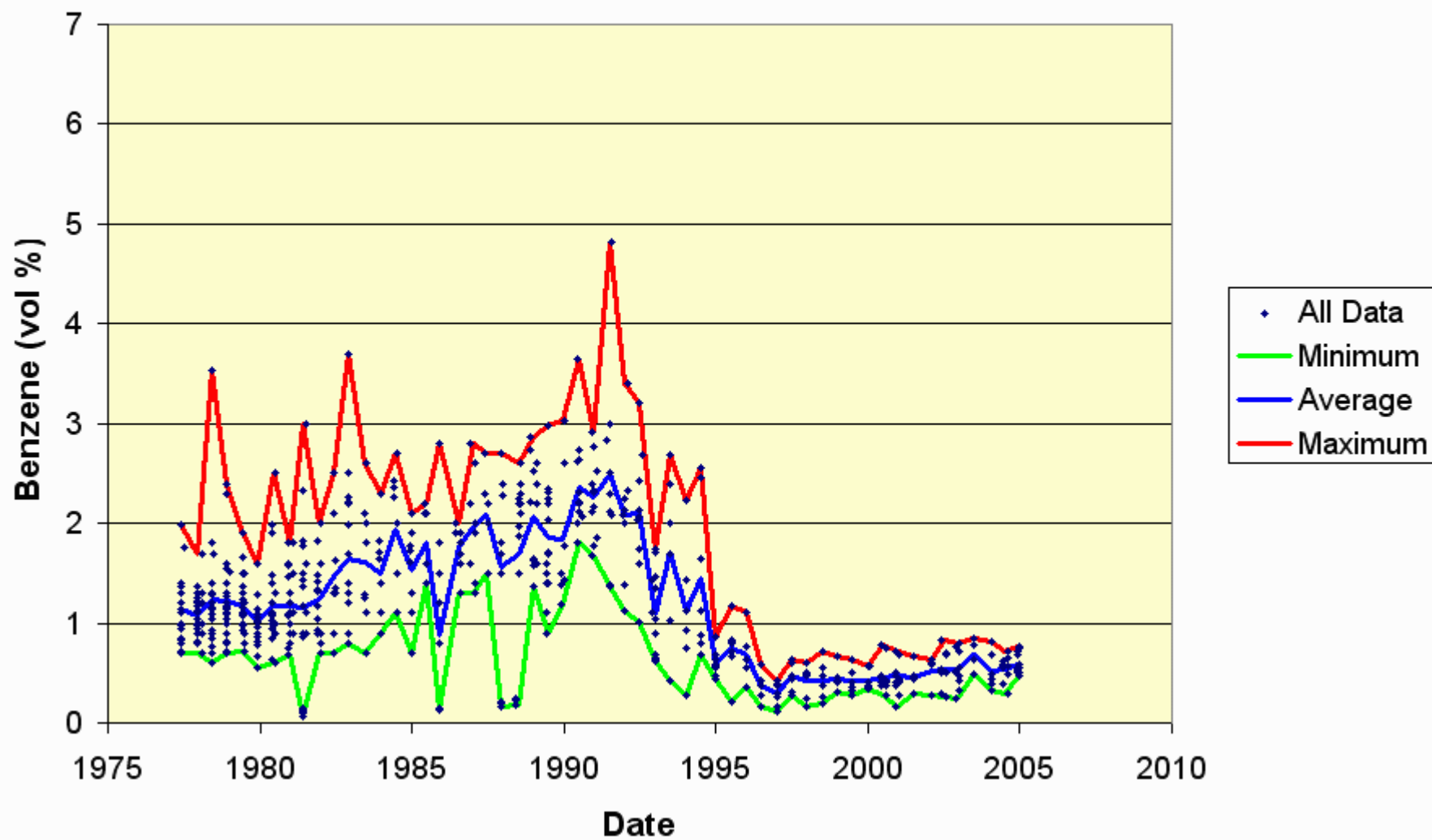
MTBE (Vol %)
1,799 Averages (31,930 Data Points)



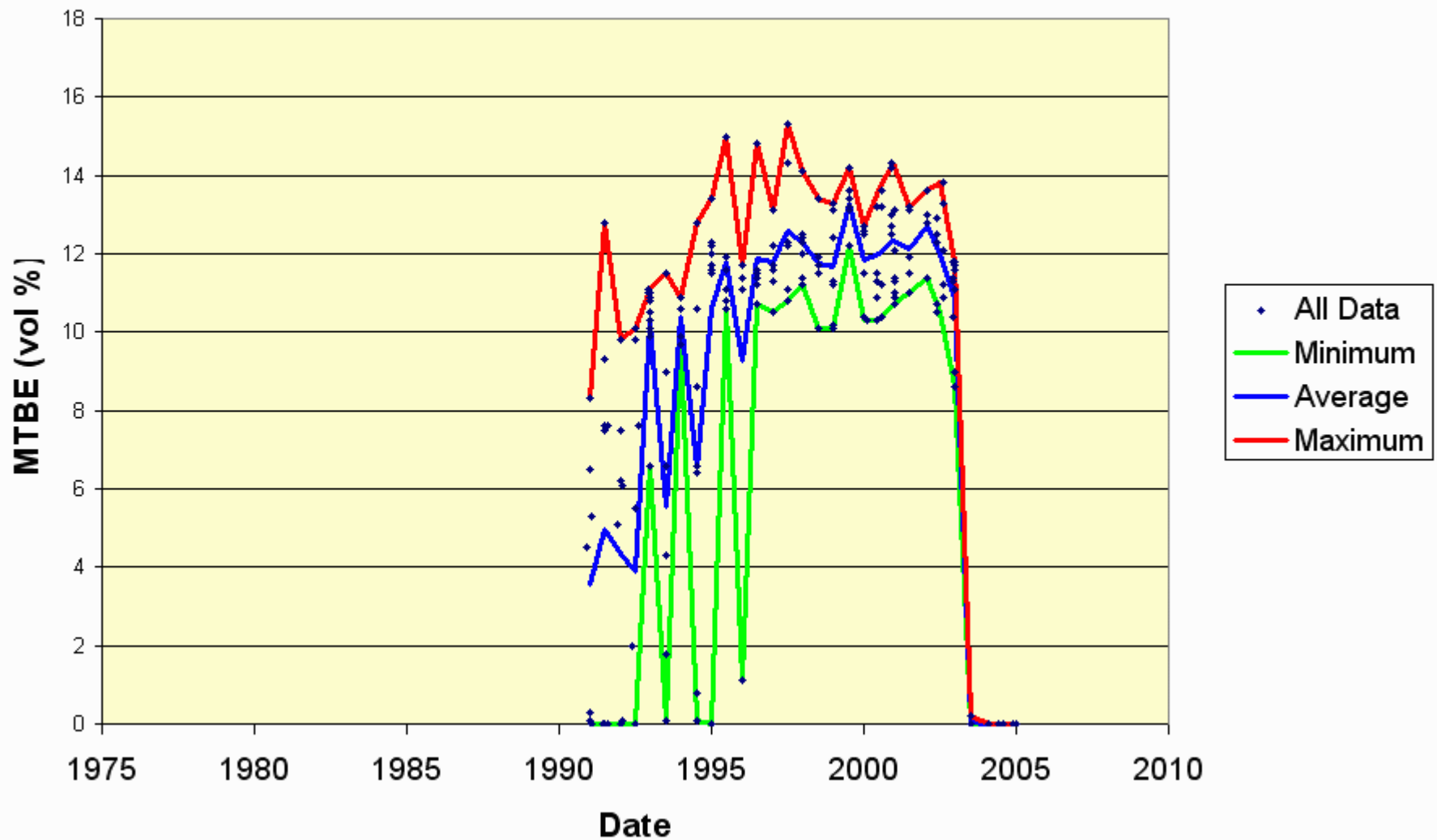
Average Ethanol (Vol %)
2,038 Averages (25,808 Data Points)



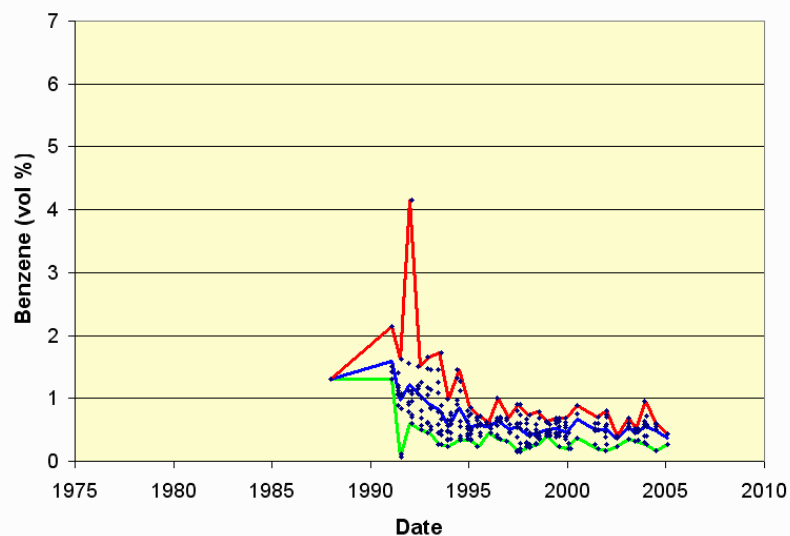
Benzene (vol %), High Octane, Los Angeles, CA



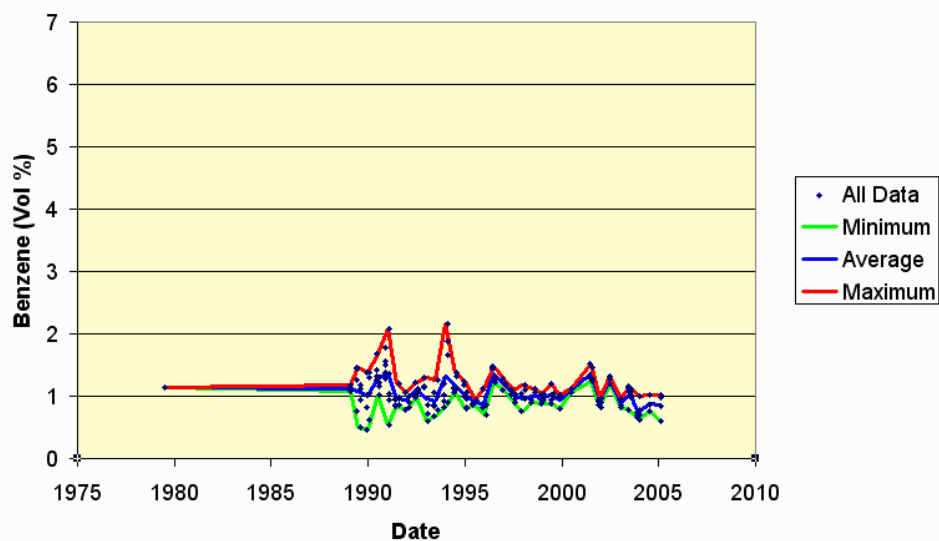
MTBE (vol %), High Octane, Los Angeles, CA



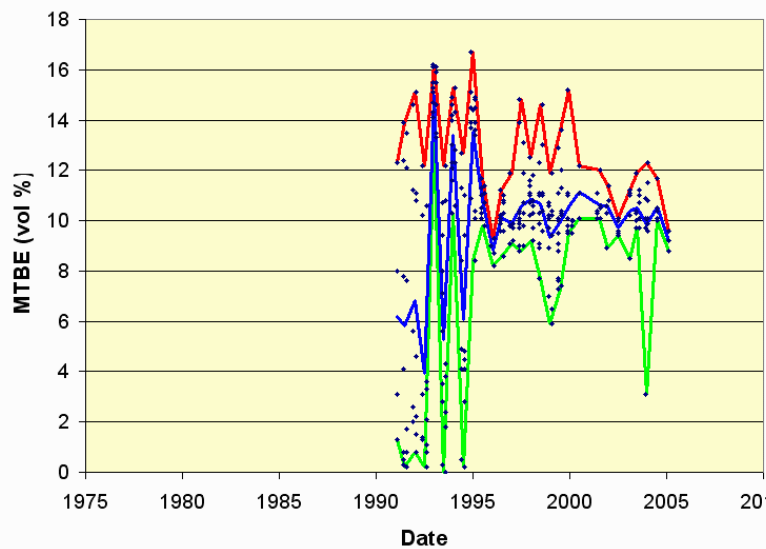
Benzene (vol %), High Octane, Washington, DC



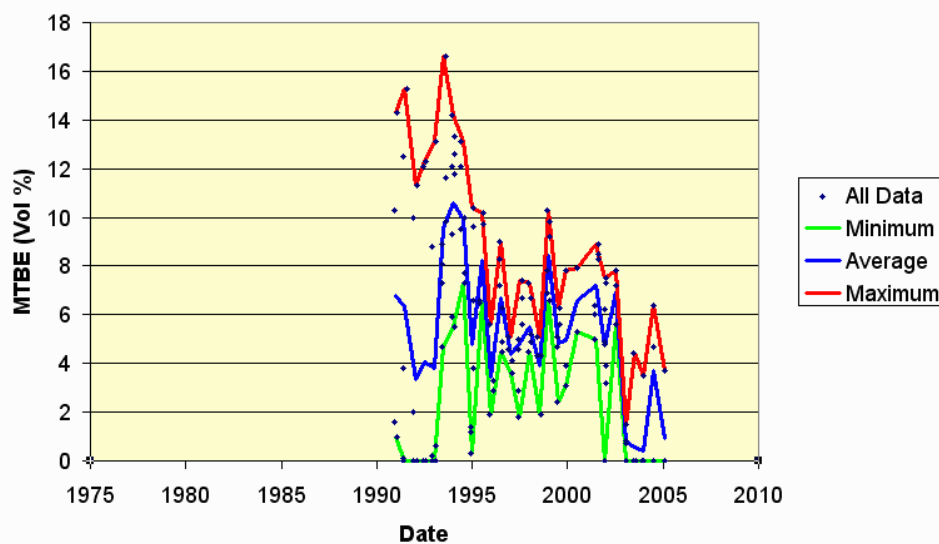
Benzene (Vol %), High Octane, Charleston, WV



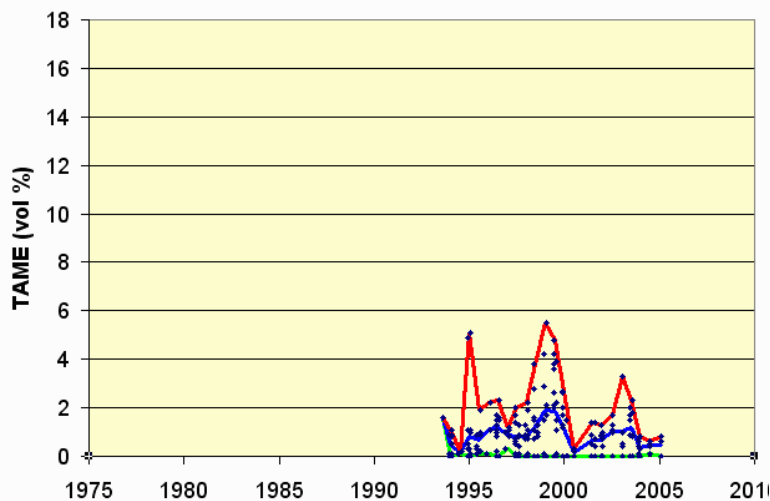
MTBE (vol %), High Octane, Washington, DC



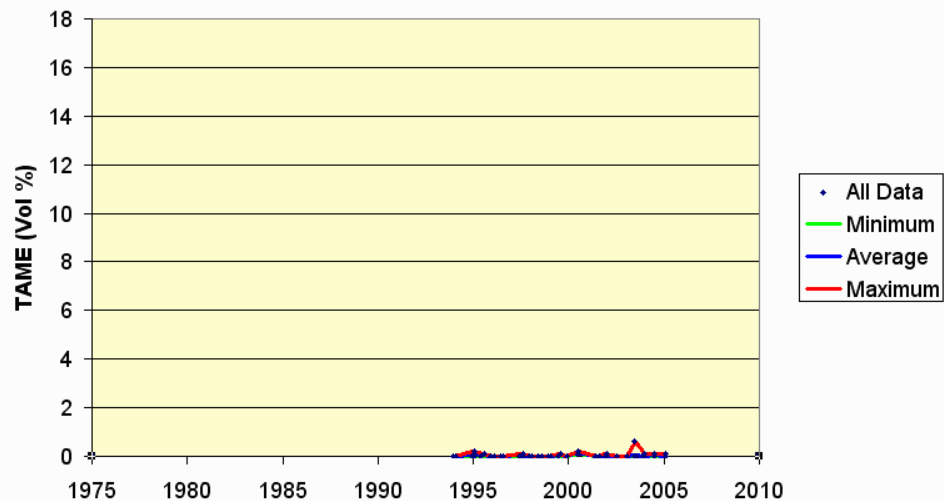
MTBE (Vol %), High Octane, Charleston, WV



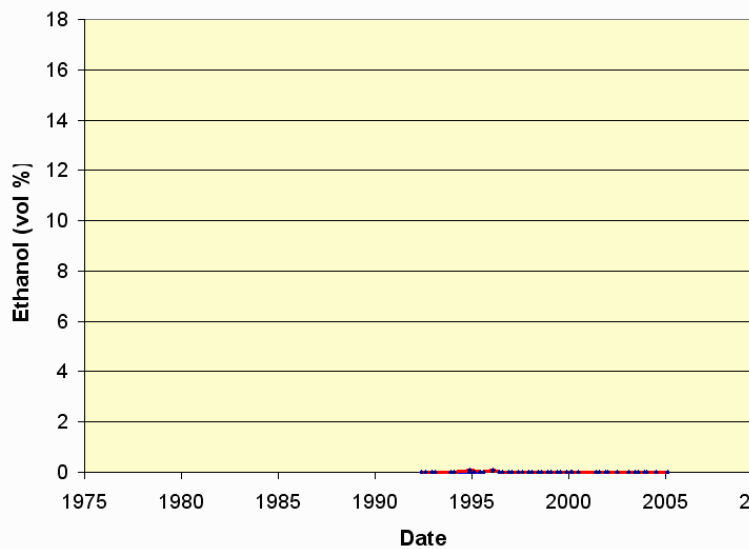
TAME (vol %), High Octane, Washington, DC



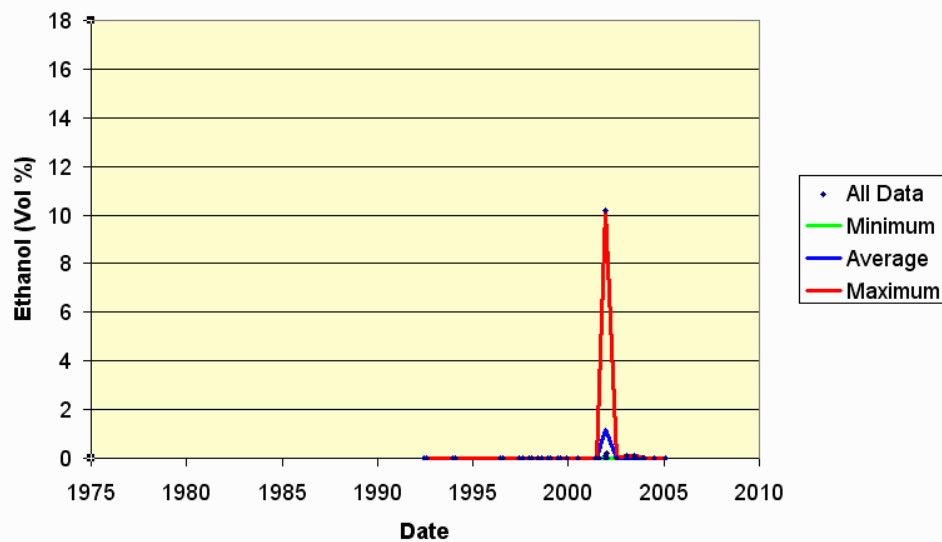
TAME (Vol %), High Octane, Charleston, WV



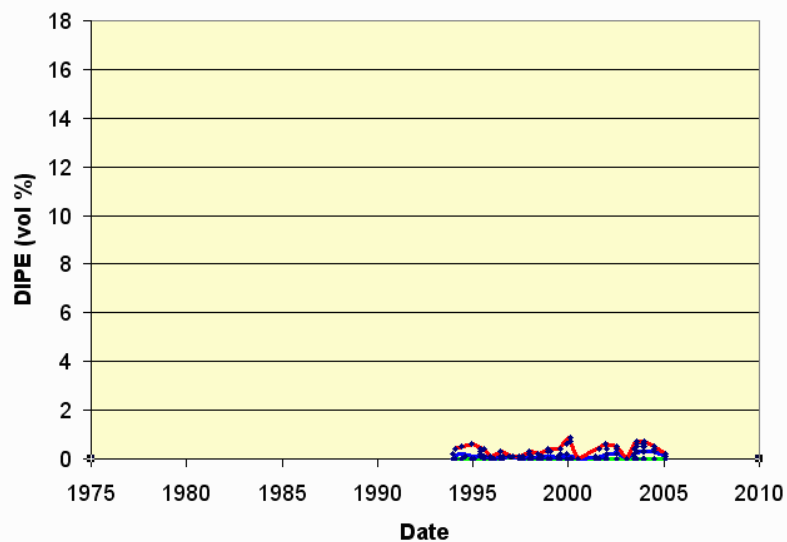
Ethanol (vol %), High Octane, Washington, DC



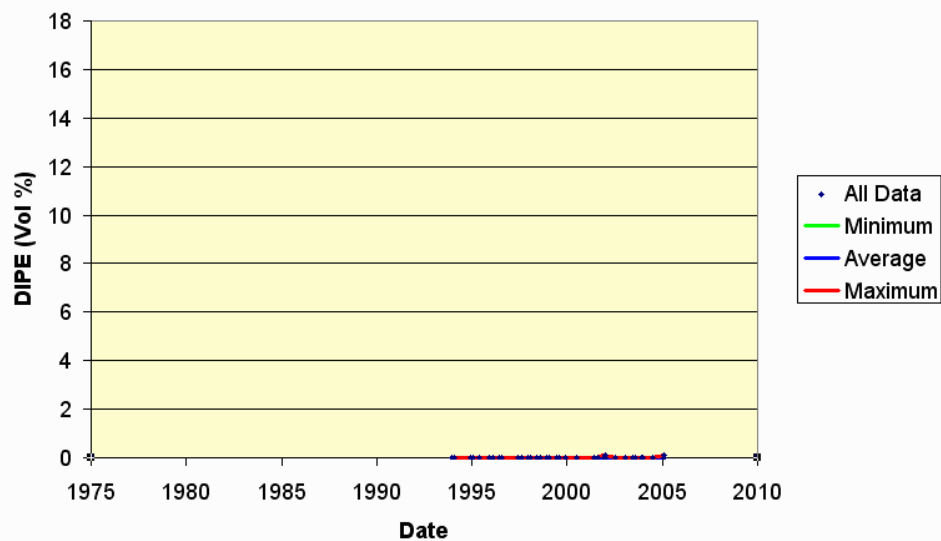
Ethanol (Vol %), High Octane, Charleston, WV



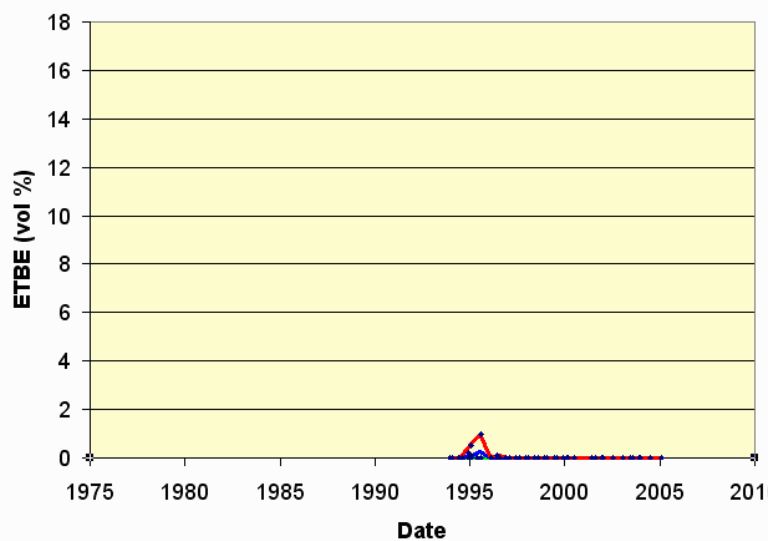
DIPE (vol %), High Octane, Washington, DC



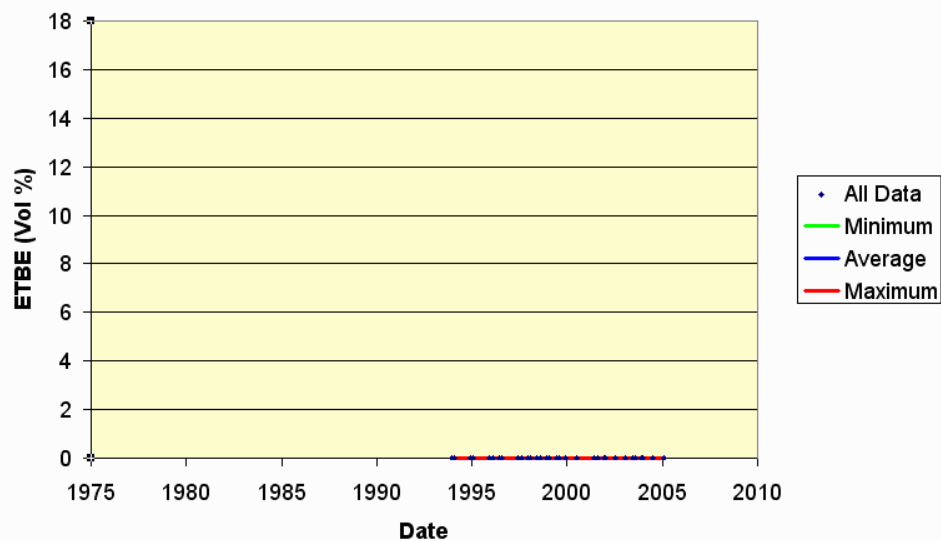
DIPE (Vol %), High Octane, Charleston, WV



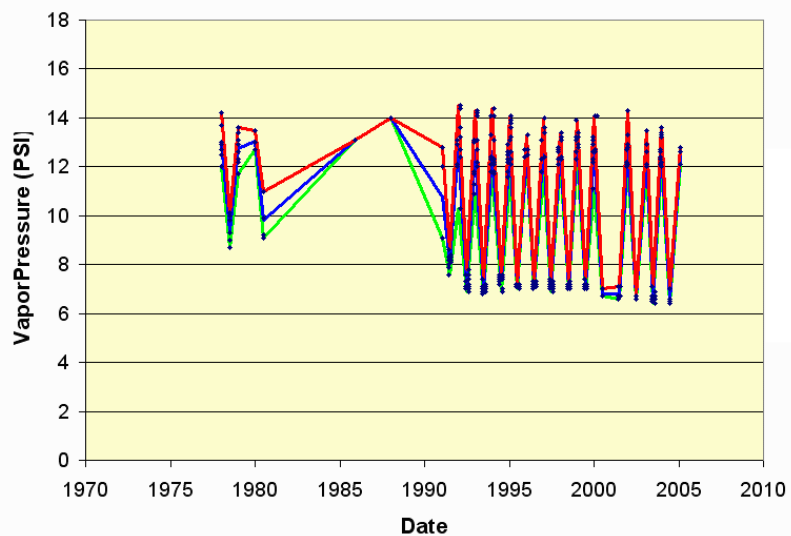
ETBE (vol %), High Octane, Washington, DC



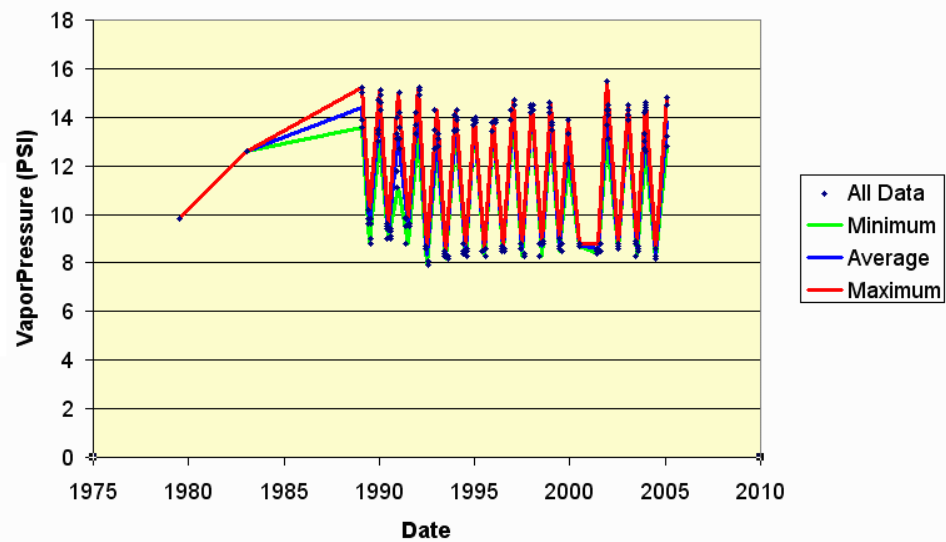
ETBE (Vol %), High Octane, Charleston, WV



VaporPressure (PSI), High Octane, Washington, DC



VaporPressure (PSI), High Octane, Charleston, WV





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Conclusions

- RFG cities show benzene limitation after 1995
- Conventional Gasoline cities show variation in benzene due to
 - Anti-dumping provisions
 - Probable supply of RFG to conventional gasoline areas
 - Use of oxygenates for octane enhancement



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Conclusions

- MTBE appeared even where not required
 - Octane enhancement
- Seasonal spiking in winter oxygenate
- Elimination with MTBE bans



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Conclusions

- Ethanol/TAME = some usage
- Summertime Vapor Pressure limitations become dominant
~1990



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Disclaimer

- Although this work was reviewed by EPA and approved for presentation, it may not necessarily reflect official Agency policy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.
- Thanks to Cheryl Dickson, Northrop Grumman